
Primary Rate Interface equipment: overview

The following machines support Primary Rate Interface (PRI):

- Beginning with X11 release 14, Meridian SL-1 ST, RT, NT, XT
- Beginning with X11 release 15, system options 21, 21A, 51, 61, and 71
- Beginning with X11 release 18, STE, 21E, and 81
- Beginning with X11 release 21, system options 51C, 71C, and 81C

This document describes the equipment and procedures needed to install the following ISDN PRI hardware on Meridian 1 systems.

- QPC757 D-channel Interface (DCHI)
- NT6D80 Multi-purpose Serial Data Link (MSDL)
- QPC720 Primary Rate Interface (PRI)
- NT5D12 dual-port 1.5 DTI/PRI card, and associated dual-port Downloadable D-Channel daughterboard (DDCH, NTBK51AA), that is used with the NT5D12 DDP in system hardware configurations as an alternative to an MSDL or a DCHI card

Note: Specific information pertaining to the NT5D12 and NTBK51AA can be found in the separate section “NT5D12 dual-port DTI/PRI card description and installation.”

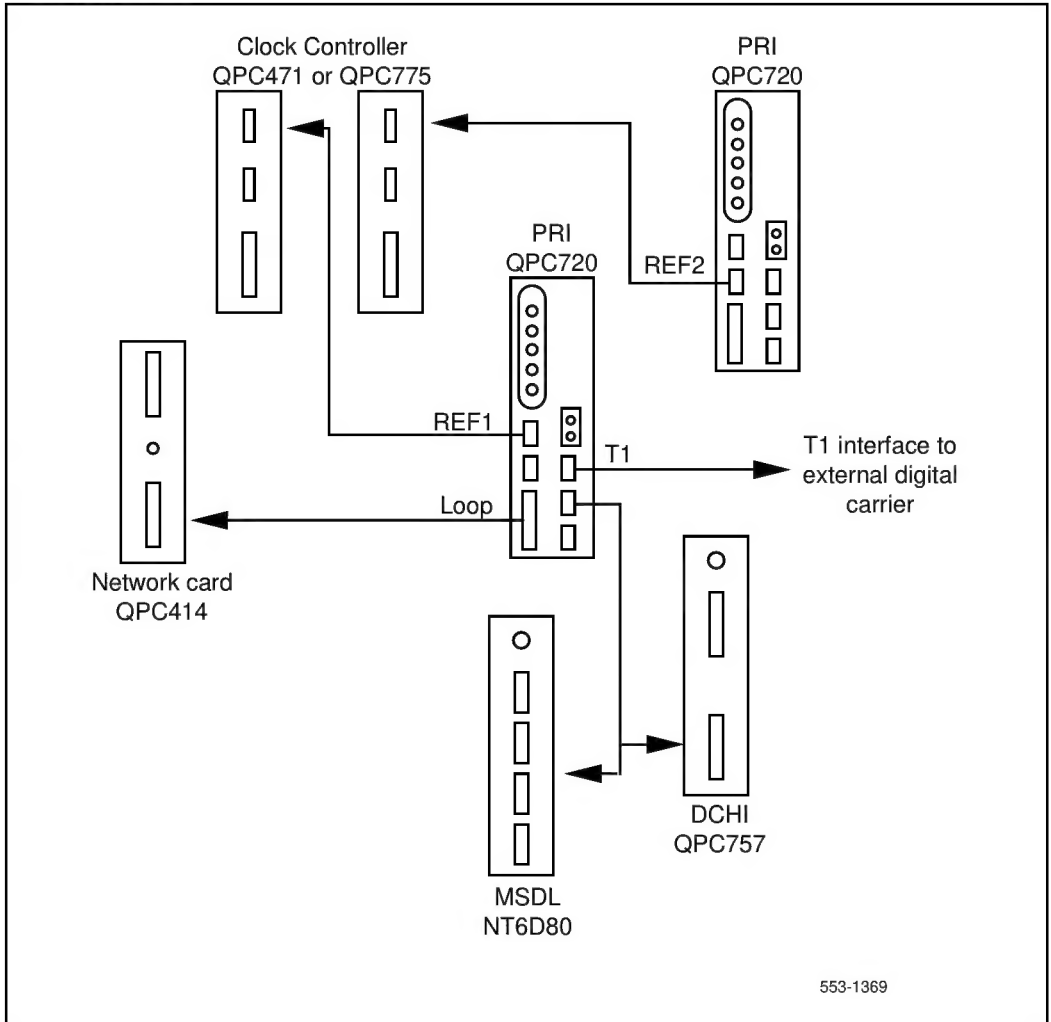
— QPC471 or QPC775 Clock Controller

The QPC775 Clock Controller is currently not available for U.S. markets. The QPC471 and QPC775 Clock Controllers cannot be mixed in one system. Vintages A through G of the QPC471 Clock Controller can be used in one system; vintage H of QPC471 Clock Controllers cannot be mixed with Clock Controllers of other vintages.

See **Figure 1** for a representation of the basic PRI system hardware.

Note: This illustration shows the basic configuration, without the dual-port NT5D12 DTI/PRI card, nor the associated dual-port NTBK51AA Downloadable D-Channel daughterboard.

Figure 1
PRI hardware



Refer to *ISDN Primary Rate Interface description and administration* (553-2901-100) for hardware vintage requirements and compatibilities, as well as packaging information.

Note: Either the QPC757 DCHI, the NT6D80 MSDL, or the QPC720 PRI can be installed first. However, PRI loops must be configured in software before defining DCHI links.

The following hardware is required for PRI capability and applications:

- QPC414 network card

Refer to *Circuit card installation and testing* (553-3001-211)

- Channel Service Unit (CSU)

Refer to information received from manufacturer

- ROM and memory, as shown in [Table 1](#),

See also *Software conversion procedures* (553-2001-320)

The NT and RT can use one QPC583A board while the XT can use up to three QPC583A boards. X11 release 15 and later software requires at least two QPC583A boards in XT machines. Systems with less than 420K data storage require an additional memory board.

Table 1
Minimum ROM requirements by machine type and X11 release

X11 release	ST, 21	STE, 21E	RT	NT, 51, 61	XT, 71	81	51C	61C	81C
14	QPC717D or QPC937	N/A	QPC602	QPC602	QPC602	N/A			
15/16/1 7	QPC940	N/A	QPC939A	QPC939	QPC939	N/A			
18	N/A	NTND31	NTND08	NTND08	NTND08				
21									

ISDN Signaling Link hardware

Equipment required for shared mode.

- QPC757 DCHI or NT6D80 MSDL
- QPC720 PRI
- QPC471 or QPC775 Clock Controller

A Clock Controller is not needed for analog applications. Both QPC471 and QPC775 Clock Controllers cannot be in one system.

Equipment required for dedicated mode using leased lines.

- QPC757 DCHI or NT6D80 MSDL
- Modem set in synchronous mode

This equipment is required for dedicated mode using a DTI.

- QPC757 DCHI or NT6D80 MSDL
- QMT11 Asynchronous/Synchronous Interface Module (ASIM)
- QMT21 High Speed Data Module (HSDM)
- Meridian Communications Unit (X11 release 18 and later)
- Data line card
- QPC472 DTI

Equipment required for dedicated mode using a dial-up modem.

- QPC757 DCHI or NT6D80 MSDL
- Modem with auto-dial capability

Note: This configuration is the least reliable because of lockup problems inherent in smart modems from power splices and noisy lines. To increase the reliability on this configuration, use a constant power source when powering the modems. Also, verify that tie lines meet data grade specifications. Northern Telecom takes no responsibility for ISL D-channel outages due to modem lockup.

The following equipment is recommended for modem connections:

Hayes Smartmodem 2400

Concord Data System CDS 224 Trispeed Series II

Anderson Jacobson AJ 2441-1

Racal-Vadic 2400 PA

QPC720 PRI

The QPC720 PRI card is required for PRI operation in all machine types.

Power requirements

The QPC720 PRI uses power and ground from the backplane. This card does not require an intelligent bus. Power requirements are

+5 volts at 6 amperes

+12 volts at 50 milliamperes

–12 volts at 50 milliamperes

QPC720 faceplate

Table 2 gives information about the external connectors located on the QPC720 PRI faceplate.

The QPC720 PRI contains five LEDs and six external connectors. **Figure 2** shows the faceplate layout.

Table 2
QPC720 PRI: external connectors

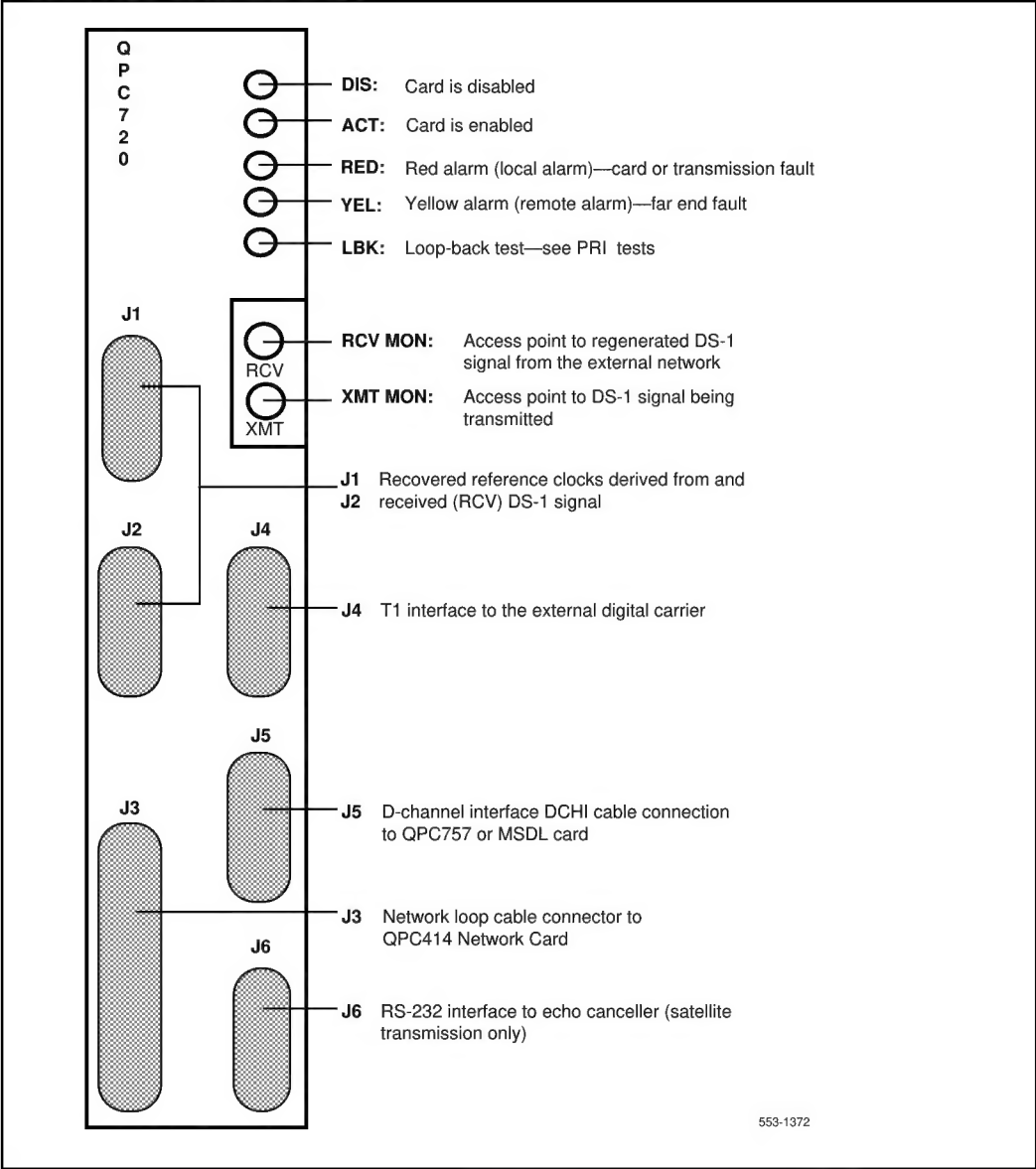
Faceplate destination	Type
J1	9-pin female, D-connector
J2	9-pin female, D-connector
J3	36-pin connector
J4	15-pin male, D-connector
J5	15-pin male, D-connector
J6	15-pin female, D-connector
RCV MON	Miniature bantam jack
XMT MON	Miniature bantam jack

Cable requirements

Table 3 lists the types of cable used and the lengths required for external QPC720 PRI connections.

Note: No additional cabling is required for nB+D configurations. Multiple PRIs and the D-channel are associated through software in LD 17, prompt PRI.

Figure 2
QPC720 PRI faceplate layout



Carrier interface

The QPC720 PRI provides an interface to the DS-1 Channel either directly, through an office repeater, or through an Echo Cancellor.

The T1 Channel Service Units listed below are compatible with the QPC720 PRI card and the 64K Clear Data feature as well as with PRI connection parameters such as the Superframe format, the Extended superframe format, and the B7 and B8ZS Alternate Mark Inversion (AMI) line coding. See *ISDN Primary Rate Interface description and administration* (553-2901-100) for more information about the connection parameters.

- Digital Link 551A
- Digital Link 551C
- Digital Link 551E
- Tellabs Model 441
- Verilink Model 551V ST

In the U.S.A., FCC Part 68 regulations require Network Channel Terminating Equipment (for example, the NT QRY551 Channel Service Unit) installed at of the point of connection between a system and a registered common carrier trunk.

Echo Cancellor interface

Echo Cancellers are required only with satellite transmission. The Echo Cancellor detects the length of the loop, then cancels reflected transmission (callers do not hear their own voices echoed).

The QPC720 PRI provides both a T1 line interface and a control interface to link to a signal format compatible with EIA standard RS-232-C. Both the PRI and the Echo Cancellor act as Data Terminal Equipment (DTE). The Echo Cancellor's control protocol must conform to that of the Tellabs Model 251.

64 T-link version 2 protocol

The QPC720 card supports the 64 T-link version 2 protocol. The QPC720 together with the QMT21 High Speed Data Module supports the 64K Clear Data feature. The QPC720 card provides a trunk that ties two switches together. This trunk allows 64K Clear Data to pass from the Meridian 1 to an outside network. The QMT21 module allows Data Terminal Equipment (DTE) to send and receive 64K Clear Data. See *ISDN Primary Rate Interface description and administration* (553-2901-100) for more information about the 64K Clear Data feature.

Table 3
QPC720 PRI: cables and cable lengths

Cable type	From	To	Maximum length (feet)	Maximum length (meters)
QCAD130	QPC720	QPC471/QPC775 (CC-0)	7	2.13
QCAD130	QPC720	QPC471/QPC775 (CC-1)	7	2.13
QCAD328A	QPC720	QPC757 DCHI	6	1.8
QCAD328B	QPC720	QPC757 DCHI	18	5.5
QCAD328C	QPC720	QPC757 DCHI	35	10.67
QCAD328D	QPC720	QPC757 DCHI	50	15.24
QCAD124	QPC720	QPC414 Network	50	15.24
QCAD128	QPC720	Bulkhead I/O panel	25	7.62
RS-232	QPC720	Echo Cancellor	50	15.24
NTND26AA	QPC720	NT6D80 MSDL	6	1.8
NTND26AB	QPC720	NT6D80 MSDL	18	5.5
NTND26AC	QPC720	NT6D80 MSDL	35	10.67
NTND26AD	QPC720	NT6D80 MSDL	50	15.24
NTND98	QPC720	Input/output panel	6	1.8
22AWG ABAM	Echo Cancellor	DSX-1	655	199.64

Note: The QPC775 Clock Controller is currently available in Canada only. There can be no mixing of QPC775 and QPC471 in one system.

QPC757 DCHI/NT6D80 MSDL

The QPC757 DCHI or NT6D80 MSDL card is required in all machine types.

Power requirements

The QPC757 DCHI/NT6D80 MSDL power requirements

- +5 volts at 3 amperes
- +12 volts at 50 milliamperes
- 12 volts at 50 milliamperes

Interface to PRI

The QPC757 DCHI connects to the QPC720 PRI via a RS-422 cable. The following signals are transmitted across the interface:

RCV DATA
RCV CLOCK
XMIT CLOCK
XMIT READY
PRI READY
DCHI READY

PRI READY and DCHI READY are handshake signals.

QPC757/NT6D80 faceplate

The QPC757 DCHI, as shown in [Figure 3](#), has one light emitting diode (LED) to indicate an active or inactive state and two external connectors as follows:

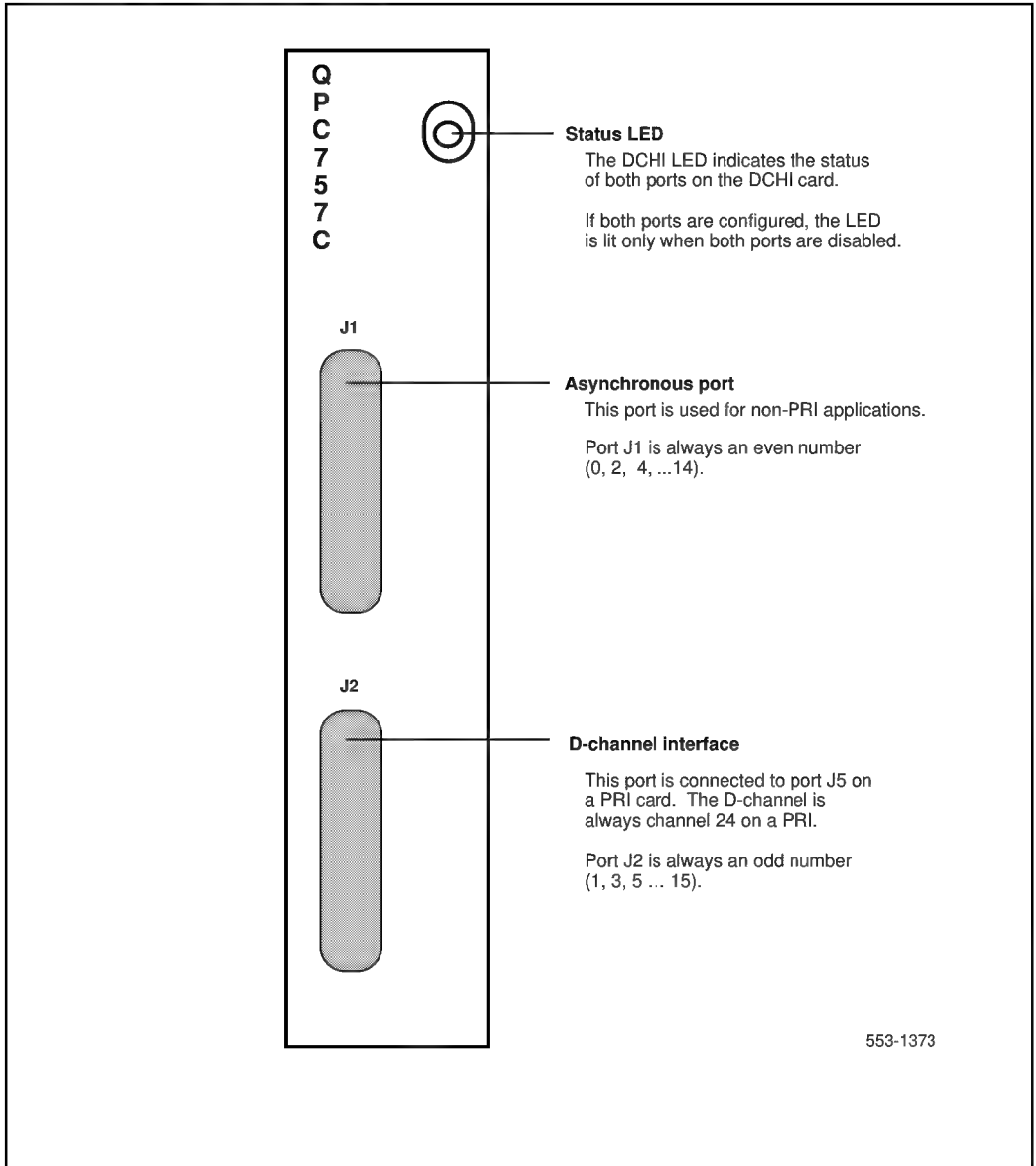
- 1 Port J1 is a standard asynchronous port in LD 48

Note: This connection does not support an Add-on Data Module (ADM) terminal.

- 2 Port J2 is the D-channel Interface port.

Note: X11 release 14 requires QPC757 vintage B or higher. A QPC757 vintage C is required if the ISL Revert to Conventional Signaling feature is configured. X11 release 15 requires a QPC757 vintage C or later. The QPC757 vintage D is recommended for combination ISL/PRI networks using NACD or Network Message Services and ISL networks using modems.

Figure 3
QPC757 DCHI faceplate layout



NT6D80 MSDL

The NT6D80 MSDL card can be used in all machines supporting X11 release 18. It can be used in conjunction with, or independently from, the QPC757 card.

Power requirements

The NT6D80 MSDL power requirements are

Voltage (VAC)	Current (Amps)	Power (Watts)	Heat (BTUs)
+5	3.20	16.00	55.36
+12	0.10	1.20	4.15
-12	0.10	1.20	4.15

MSDL/PRI interface

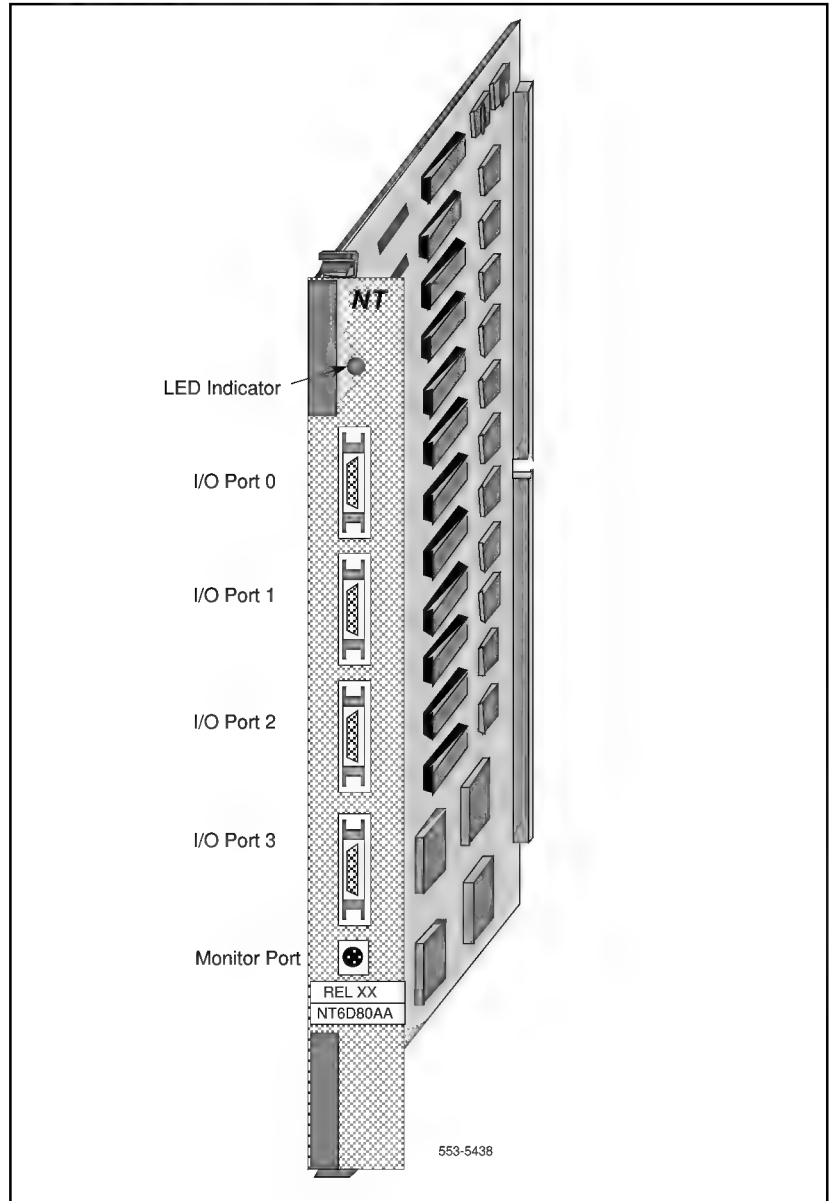
MSDL can connect to PRI trunks through RS-422 or RS-232 interfaces. The interfaces are switch configurable.

MSDL faceplate

The NT6D80 MSDL as shown in [Figure 4](#) has one light emitting diode (LED) that indicates its state (active or inactive) and four external connectors.

Each port can be RS-422 or RS-232 connectors, with either DCE or DTE interfaces.

Figure 4
NT6D80 MSDL faceplate layout



Clock operation

There are three types of clock operation: tracking mode, free run mode, and holdover mode.

Tracking mode

In tracking mode, the PRI loop supplies an external clock reference to a Clock Controller. Two PRI loops can operate in tracking mode, with one defined as the primary reference source for clock synchronization, the other defined as the secondary reference source. The secondary reference acts as a back-up to the primary reference. Both the primary and secondary references are assigned in LD 73. Each should have its own clocking source.

As shown in [Figure 5](#), a Meridian 1 system with dual CPUs can have two Clock Controllers (CC-0 and CC-1). One Clock Controller acts as a back-up to the other. The Clock Controllers should be completely locked to the reference clock.

Free run (non-tracking) mode

The clock synchronization for a PRI loop can operate in free run mode if the following conditions are true:

- The loop is not defined as the primary or secondary clock reference.
- The primary and secondary references are disabled.
- The primary and secondary references are in red alarm (local alarm).

Holdover mode

Holdover mode, available for vintages G and H, saves clock references, remembering the last position and retaining it if system operation is interrupted. Holdover mode maximizes synchronization accuracy.

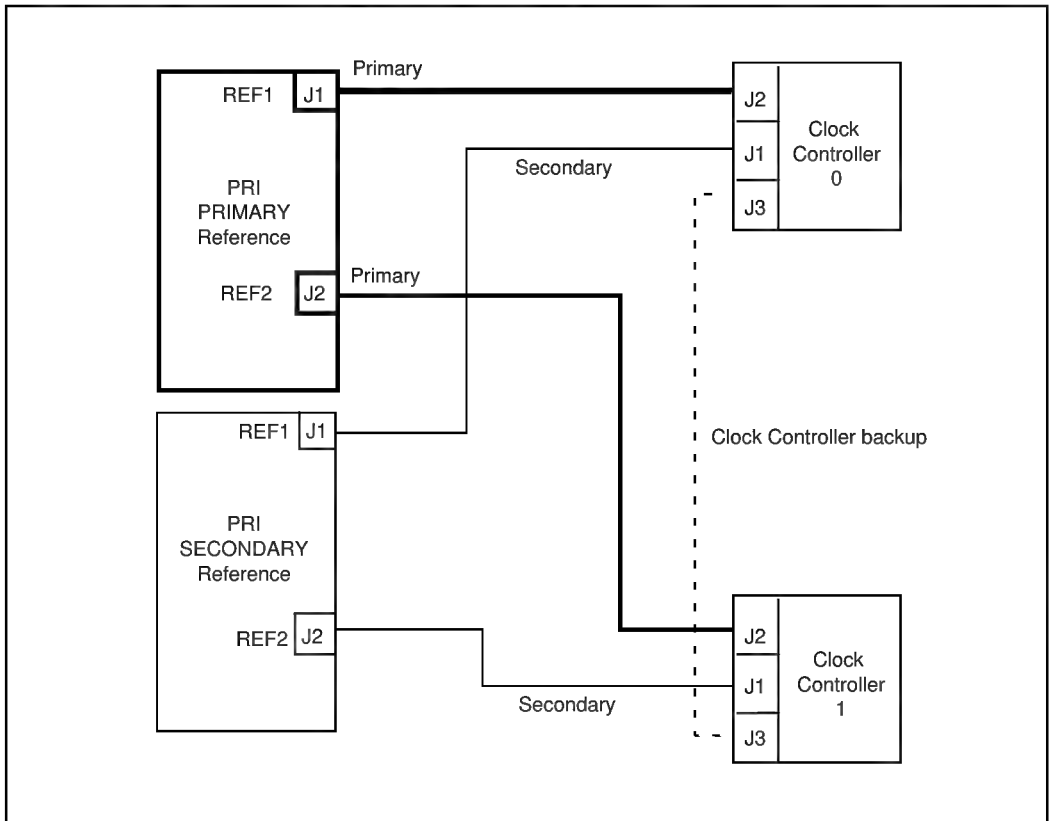
Reference clock errors

Meridian 1 software checks every 15 minutes to see if a Clock Controller or reference clock error has occurred.

In tracking mode, at any one time, there is one active Clock Controller, which is tracking on one reference clock. If a Clock Controller error is detected, the system switches to the back-up Clock Controller without affecting which reference clock is being tracked.

A reference clock error occurs when there is a problem with the clock driver or with the reference system clock at the far end. If the Clock Controller detects a reference clock error, the reference clocks are switched.

Figure 5
Clock controller primary and secondary tracking



Automatic clock recovery

Automatic clock recovery provides for the clocking devices, down because of a PRI loop problem, to return to operation as soon as the PRI loop recovers.

With X11 release 14, you must enable the Auto recovery in LD 60 with the command EREF as well as in LD 70 with AUTO = YES. With X11 release 15 and later, enable it in LD 73 with AUTO = YES. LD 60 is not required.

A PRI loop is disabled when it enters a red alarm (local alarm) condition. If the red alarm is cleared, the loop is enabled automatically. When the loop is enabled, clock tracking is restored under the following conditions:

- 1 If the loop is assigned as the primary reference clock but the Clock Controller is tracking on the secondary reference or in free run mode, it is restored to tracking on primary.
- 2 If the loop is assigned as the secondary reference clock but the Clock Controller is in free run mode, it is restored to tracking on secondary.

If the 15-minute clock check indicates the system is in free run mode:

- 1 Tracking is restored to the primary reference clock (if defined).
- 2 If the primary reference is disabled or in red alarm (local alarm), tracking is restored to the secondary reference clock if defined.

If the system was put into free run mode intentionally by the craftsperson, it resumes tracking on a reference clock at this time unless the clock-switching option has been disabled (LD 60, command MREF), or the reference clock has been undefined in the database.

Automatic clock switching

Tracking on the primary or secondary reference clock is automatically switched in the following manner, when clock recovery is enabled.

- 1 If software is unable to track on the assigned primary reference clock, it switches to the secondary reference clock.
- 2 If software is unable to track on the assigned secondary reference clock, it switches to free run.

DTI to PRI conversion

The QPC720 PRI circuit card can be used in Digital Trunk Interface (DTI) mode. If the circuit card is switched from DTI mode to PRI mode, use

Procedure 1.

Procedure 1

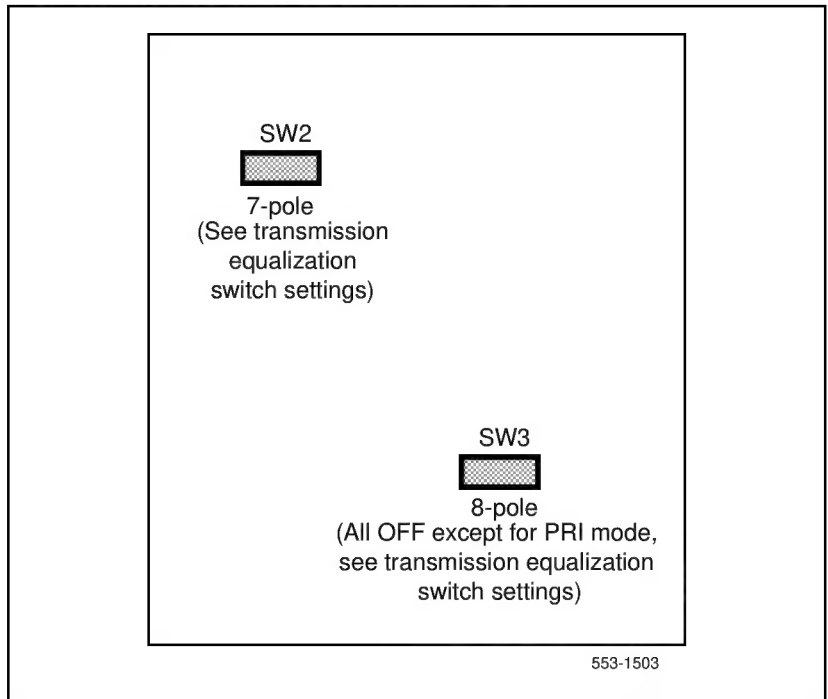
DTI to PRI conversion

- 1** Disable the QPC720 PRI using LD 60, prompt DISL x.
- 2** Change option switch settings on the PRI circuit card as required. Refer to **Figure 6** and **Table 4**.
- 3** If the PRI links the D-channel, connect J5 to QPC757 DCHI J2 with a QCAD328A cable. You can also connect the PRI to an MSDL card with the cables noted in **Table 3** (with X11 release 18 and later).

If this PRI does not supply the D-channel (it is one of multiple PRIs in an nB+D configuration), no additional cabling is required. The D-channel is associated through software in LD 17, prompt PRI.

The LEDs flash three times to indicate the QPC720 is operable.
- 4** Configure your database. Refer to *ISDN Primary Rate Interface description and administration* (553-2901-100) and *X11 input/output guide* (553-3001-400) for database implementation.

Figure 6
PRI circuit card (QPC720) option settings



Use the same SW2 settings in the table below for transmission equalization with QPC720 in Primary Rate Interface (PRI) mode or Digital Trunk Interface (DTI) mode.

Table 4
Transmission equalization switch settings for QPC720 PRI/DTI mode

Switch S2 settings	To repeated facility	To cross-connect point
5 on	0–45 m (0–150 ft)	0–30 m (0–100 ft)
2, 4, 6 on	46–135 m (151–450 ft)	31–100 m (101–355 ft)
1, 3, 7 on	136–225 m (451–750 ft)	101–200 m (356–655 ft)
Switch 3 option for DTI with ESF		
SW3–1 on = extended superframe format (ESP) off = superframe format (SF)		
Note 1: All positions on S2 (location B22) are OFF except as shown under the column labeled “Switch S2 settings.”		
Note 2: The switch 3 option for DTI with ESF applies to only X11 release 16, 17, and 18. All other positions on the 8-pole SW3 (location E37) should be OFF.		
Note 3: Prior to X11 release 19 (releases 16, 17, and 18), you must set the framing format as ESF with the DLOP prompt in LD 17 before you set SW3–1 on the card for the DTI with ESF option.		
Note 4: Beginning with X11 release 19, framing format, line encoding, and method of yellow alarm are selectable for both DTI and PRI in LD 17 with the DLOP, LCMT, and YALM prompts. All SW3 switch positions should be OFF.		